AP Biology – Fall 2017 Edward R. Murrow High School
Exam 2 Review Sheet Mr. Sprague

Format:

Section I 28 multiple choice questions
Section II 1 essay question and 3 short free response questions

Reading: Hillis chapters 3 and 4 (and all previous readings)

Concepts to Review:

- EVERYTHING FROM EXAM 1

- Biochemistry
  - Know the monomers, polymers, and functions of *carbohydrates*, *lipids*, *nucleic acids*, and *proteins*.
  - Be able to recognize diagrams of *monosaccharides*, *fatty acids*, *glycerol*, *nucleotides*, and *amino acids*.
  - Be able to describe the factors that influence the primary, secondary, tertiary, and quaternary levels of protein structure.
  - Be able to explain the way that an enzyme works, including the roles of *substrates*, *coenzymes*, *activators*, *inhibitors*, *kinases*, and *allosteric regulators*.
  - Be able to explain how environmental factors (temperature, pH, salinity, enzyme/substrate concentration) affect enzyme activity.

- Cells
  - Be able to calculate the surface area and volume of a cell (see formula sheet).
  - Be able to explain the significance of surface area and volume for a cell.
  - Be able to explain the major differences between prokaryotic and eukaryotic cells.
  - Know all the structure and function of all cell organelles in chapter 4, and which organisms they are found in.
  - Be able to recognize diagrams of the cell organelles in chapter 4.
  - Be able to predict some possible functions of a cell based on which organelles are found in large or small numbers in that cell.

- Labs
  - Understand the term *model*.
  - Be able to write a hypothesis and identify the *independent variable*, *dependent variable*, *control group*, *experimental group*, and *constants* (see Elements to Consider when Designing a Controlled Experiment handout).
  - Understand why large sample sizes, multiple trials, and statistical analyzes are used to verify results.
  - Be able to graph data appropriately and add 95% confidence intervals to a graph.
  - Be prepared to discuss the following labs: *Enzyme Catalysis* and *Toothpickase*.
  - Be able to explain how and why the rate of enzyme activity changes over time.
  - Be able to calculate the rate of a chemical reaction using the slope formula (dy/dx or dY/dt).

Overarching Questions to Consider:

Suggestion: Answer all of these questions in writing, then compare answers with a classmate. I promise that taking the time to do so will be well worth it and much more useful then memorizing facts and definitions.

1. Why do cells require enzymes? If an enzyme does not change a chemical reaction, how does it make the reaction go faster?
2. Why do different amino acids have different properties? Why does changing the primary structure of a protein result in changes to the secondary, tertiary, and quaternary levels too?
3. Why does altering the temperature or pH cause an enzyme to denature? Why is a denatured protein unable to function?
4. Why does the rate of an enzyme-mediated reaction increase at first, then level off as you add more substrate?

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5. How are the time of a reaction, the amount of substrate used, the amount of product formed, and the reaction rate related?
6. How does DNA control cell activities and give you your unique characteristics?
7. Why is it better for a cell to have a higher surface-area-to-volume ratio?
8. How does the presence of membrane-bound organelles provide eukaryotes with an evolutionary advantage over prokaryotes?
9. How do mitochondria and chloroplasts show evidence of endosymbiosis?
10. How does the relative amount of various organelle types in a cell give us hints about the cell's function?

Practice Exam Questions:

Visit the course website and click on the "Multiple Choice Practice" link. Complete all practice questions for the relevant chapters and check your work against the answer key. Note: these items are password protected.

Essay Question Sneak Peak:

Read each question carefully and completely. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable.

1. An experiment was conducted to measure the reaction rate of the human salivary enzyme α-amylase. Ten mL of a concentrated starch solution and 1.0 mL of α-amylase solution were placed in a test tube. The test tube was inverted several times to mix the solution and then incubated at 25°C. The amount of product (maltose) present was measured every 10 minutes for an hour. The experiment was repeated five times and the resulting means and 2 standard errors of the mean are provided in the table below.

MALTOSE PRODUCTION AS A RESULT OF α-AMYLASE CATALYSIS

Time (minutes)	Mean Maltose Concentration (μM)	$2SE_{\overline{X}}$
0	0.0	0.0
10	5.1	1.2
20	8.6	1.2
30	10.4	1.0
40	11.1	1.0
50	11.4	0.8
60	11.5	0.8

(a) On the axes provided, **construct** an appropriately labeled graph to illustrate the mean maltose concentration over time to within 95% confidence.

(b) **Calculate** the rate of the reaction in $\frac{\mu\text{M}}{\text{minute}}$ for the time period 0 to 30 minutes.

(c) **Describe** how the reaction rate changed after 30 minutes and **provide reasoning** to connect this change to enzyme-substrate interactions.

(d) **Propose** an appropriate control treatment for the experiment. **Describe** the results you expect to see in the control group and **explain** how these results would provide support for the claim that α-amylase catalyzes the hydrolysis of starch into maltose.

(e) **Predict** how each of the following changes are likely to affect the reaction rate. **Provide support** for your predictions by connecting each factor to changes in the structure of the enzyme.

- Adding a noncompetitive inhibitor to the mixture
- Decreasing the pH from 7.0 to 4.0